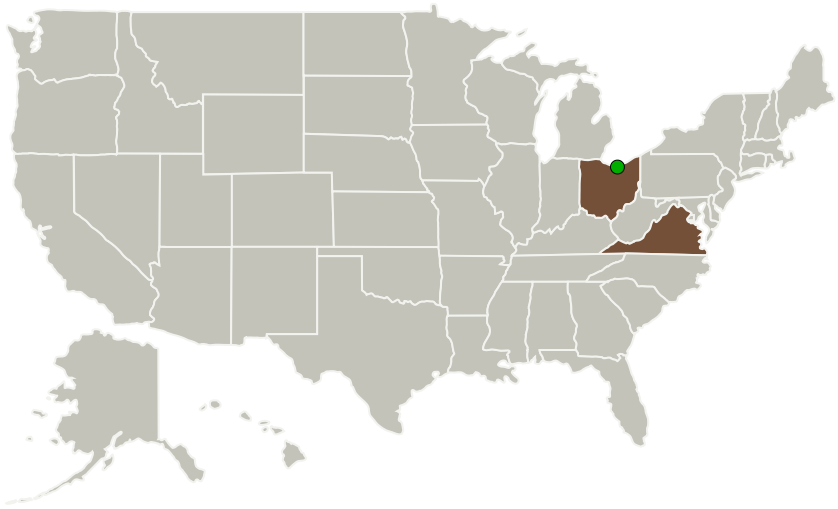
Flexible, High Char Yield Hybridsil Adhesive Materials for Next Generation Ablative Thermal Protecti, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

NanoSonic will create and empirically validate flexible, high char yield HybridSil adhesive nanocomposites for use within current and next generation polymer based ablative thermal protection systems during the proposed NASA SBIR program. Building from its established high temperature HybridSil material technology, NanoSonic will develop a room temperature cured hybrid organic — inorganic adhesive material for bonding polymer infused tiles within advanced thermal protection systems. The proposed HybridSil nanocomposite will be molecularly engineered for exceptional adhesion to both EDL substrates and currently employed high temperature thermosets (phenolic, epoxy, and cyanate ester) while maintaining high strains to failure and a rapid conversion robust silicates at elevated temperatures for additional substrate protection. Leveraging a base HybridSil thermoset that has previously demonstrated promising HyMETS performance as a carbon felt infusing resin (Figure 1 and right inset), NanoSonic will synthesize hybrid organic — inorganic block and segmented copolymers molecularly engineered for exceptional adhesion to carbon felt tiles infused with aromatic thermosets while maintaining glass transition temperatures < - 100 oC and high strains to failure (>100%) for retained flexibility in space. Promising structure — property interdependencies affording adhesive materials with extreme ablative adhesion, high char yields, and thermal resilience will be empirically down-selected through rigorous high temperature (2,000 oC) flow testing with the Department of Aeronautics and Astronautics at the University of Washington.

Primary U.S. Work Locations and Key Partners



FLEXIBLE, HIGH CHAR YIELD HYBRIDSIL ADHESIVE MATERIALS FOR NEXT GENERATION ABLATIVE THERMAL PROTECTION SYSTEMS, Phase I

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Small Business Innovation Research/Small Business Tech Transfer

Flexible, High Char Yield Hybridsil Adhesive Materials for Next Generation Ablative Thermal Protecti, Phase I

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Organizations Performing Work	Role	Type	Location
Nanosonic, Inc.	Lead Organization	Industry	Pembroke, Virginia
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139937)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nanosonic, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

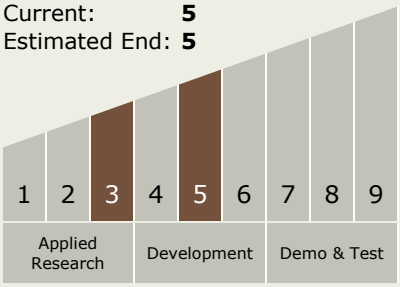
Carlos Torrez

Principal Investigator:

Victor V Baranauskas

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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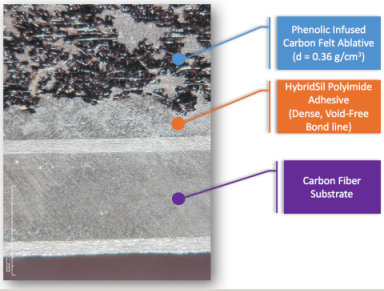
Completed Technology Project (2016 - 2016)

Images

Briefing Chart Image
FLEXIBLE, HIGH CHAR YIELD HYBRIDSIL ADHESIVE MATERIALS FOR NEXT GENERATION ABLATIVE THERMAL PROTECTION SYSTEMS, Phase I
(https://techport.nasa.gov/image/132260)



Final Summary Chart Image
FLEXIBLE, HIGH CHAR YIELD HYBRIDSIL ADHESIVE MATERIALS FOR NEXT GENERATION ABLATIVE THERMAL PROTECTION SYSTEMS, Phase I Project Image
(https://techport.nasa.gov/image/136181)

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.1 Aeroassist and Atmospheric Entry
    - TX09.1.1 Thermal Protection Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System